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(54) A device with tined rotors

(57) A device for laying material such as straw includes a pair of tined rotors (16) located behind each straw discharge position for displacing the discharged straw sideways. The rotors (16) are arranged at an angle to one another and are mounted on arms (18) for up and down movement. The arms (18) are of two part construction with an intermediate joint (28) which allows adjustment of the angle between the rotors (16). Device support wheel (12) is positioned behind each straw discharge position to run over the discharged straw and flatten it prior to the rotor-induced sideways displacement thereof.

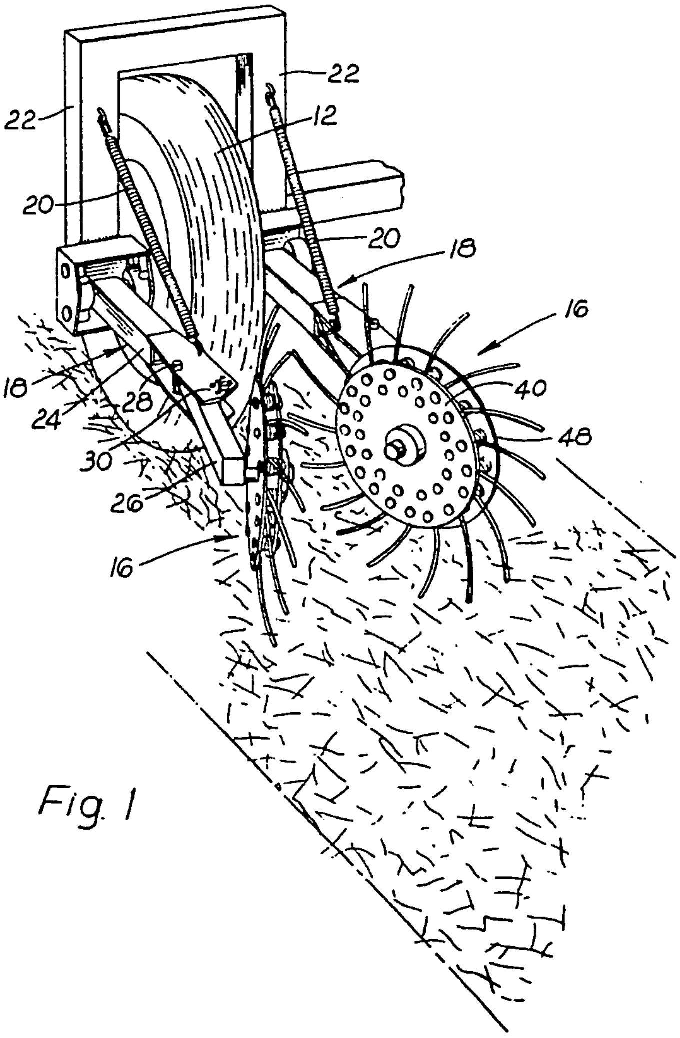

Fig. 1

The drawing(s) originally filed was/were informal and the print here reproduced is taken from a later filed formal copy.

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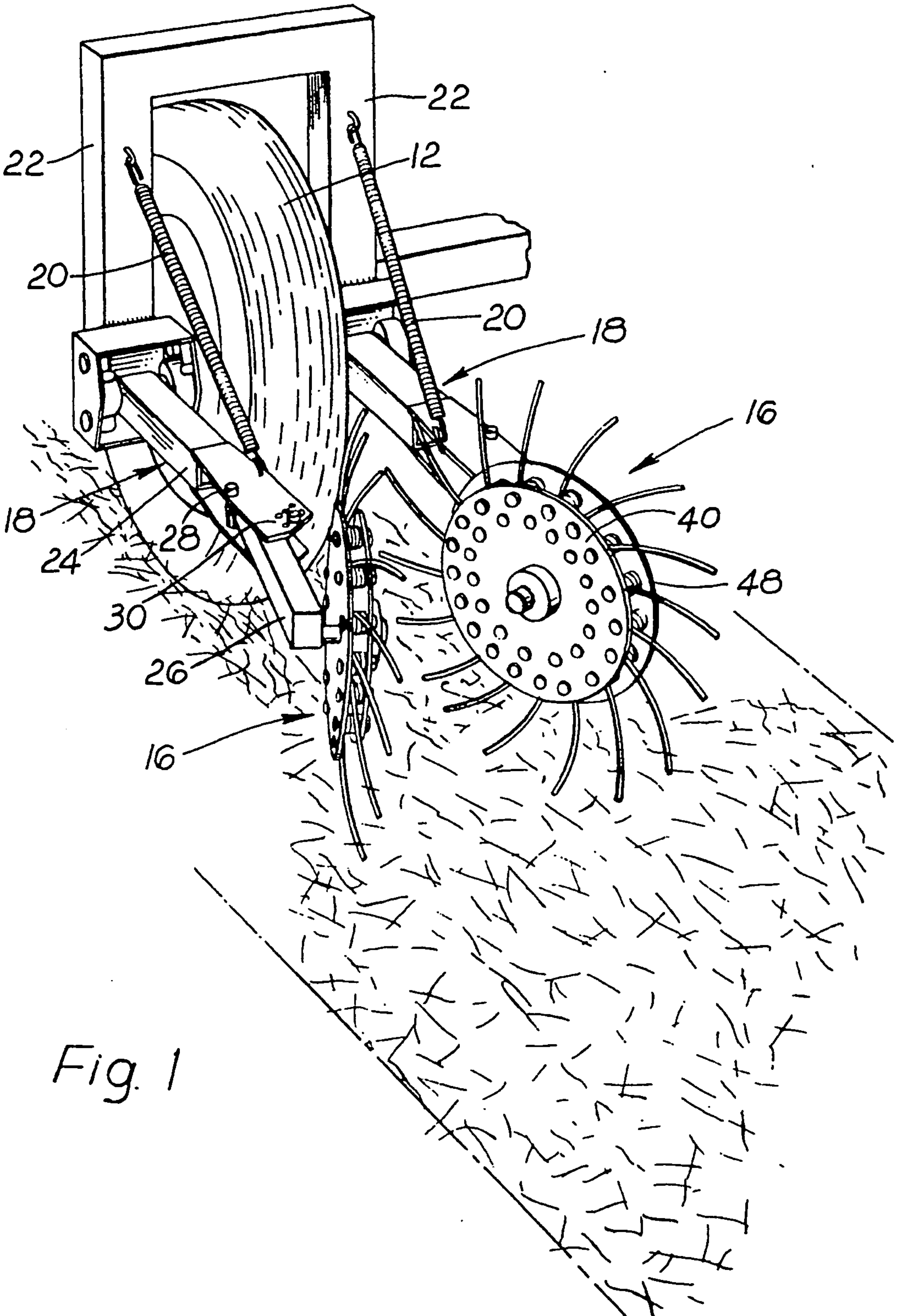

Fig. 1

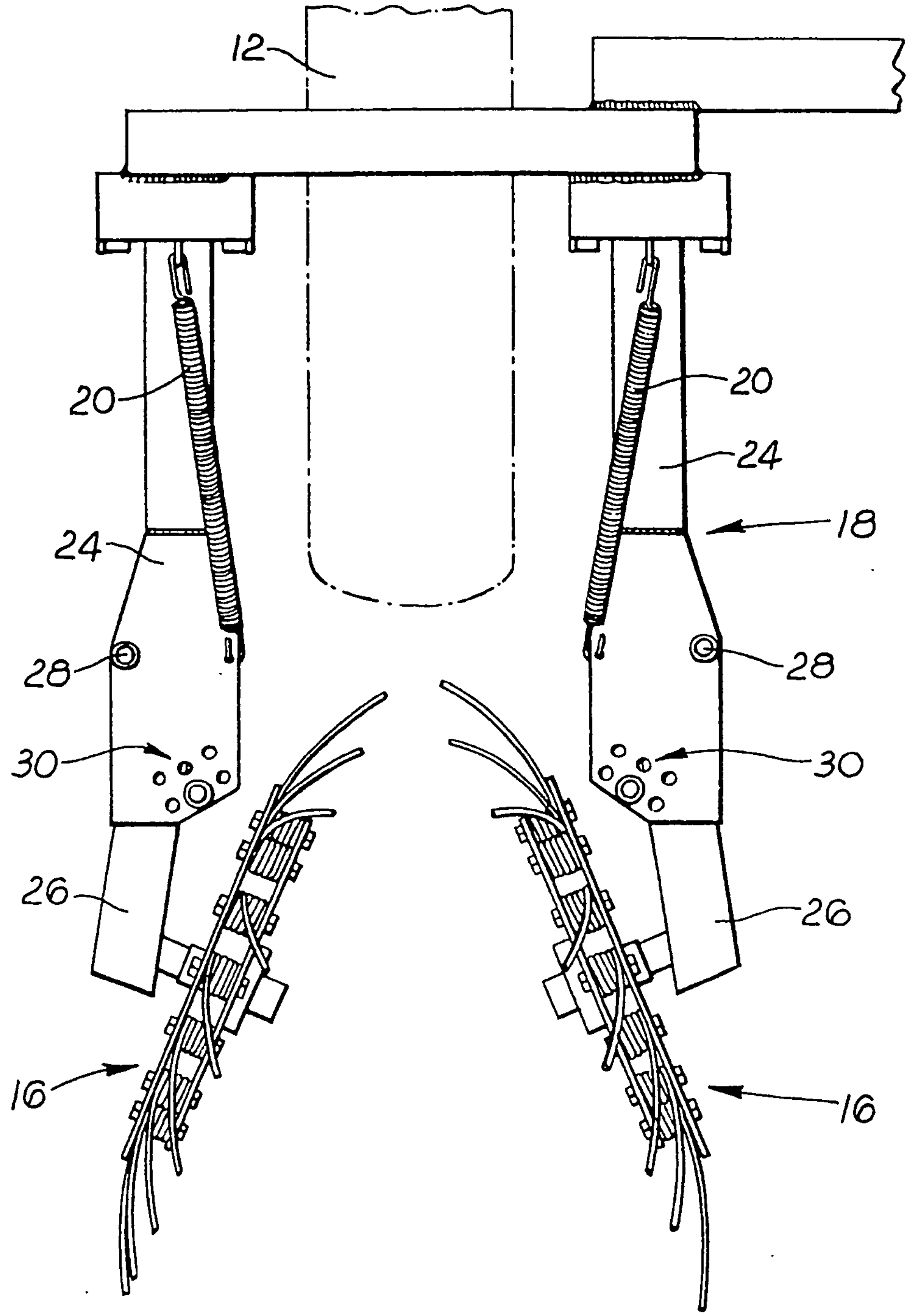

Fig. 2

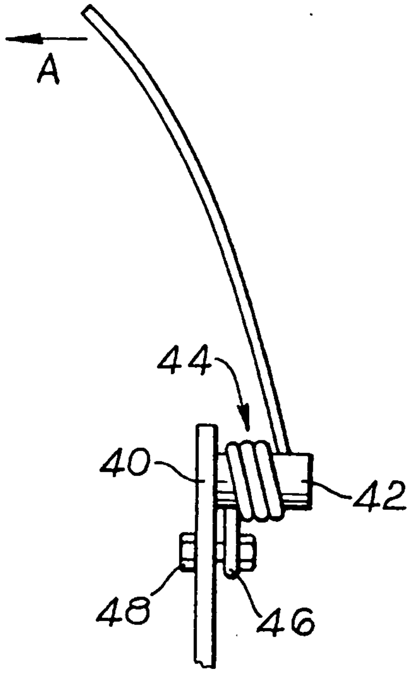

Fig. 3

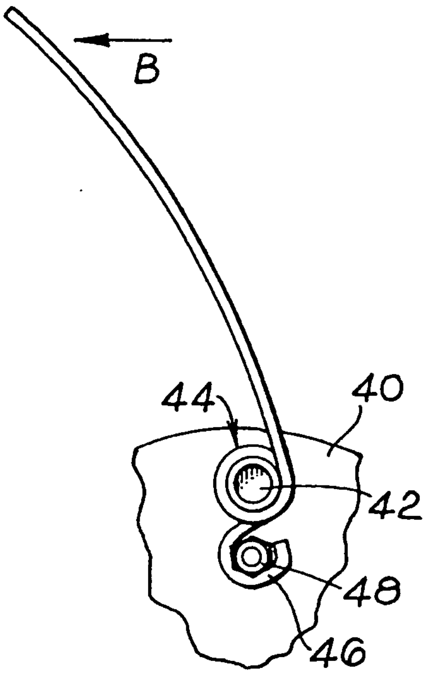

Fig. 4

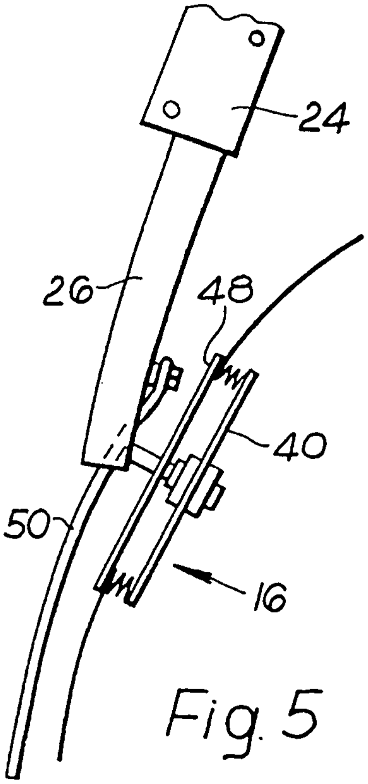

Fig. 5

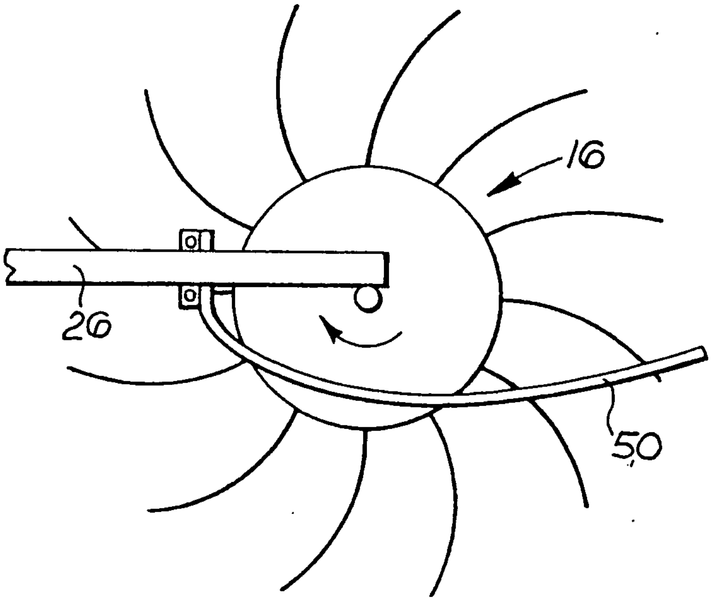

Fig. 6

SPECIFICATION

A device with tined rotors

In its broadest aspect, the present invention relates to a device having tined rotors, which device is capable of use in various agricultural and horticultural applications.

In one aspect, the invention is concerned with a device for distributing material such as straw after it has been deposited in the form of a layer on the ground. The device is especially intended for use in conjunction with straw laying apparatus such as that disclosed in prior published patent application No. 2014422, the disclosure of which is incorporated herein by reference. For brevity, such straw laying apparatus is hereinafter referred to as the Powell straw layer.

In use, the Powell straw layer serves to convert a bale of straw into a layer of straw which is deposited on the ground between for example rows of strawberry plants. Although the Powell straw layer achieves results comparable to hand laying especially in so far as straw is laid without any chopping action, in practice there is a requirement for the deposited layer to be distributed sideways in such a way that the straw is tucked under the plants in each row flanking the deposited straw layer. Thus, in the past, whilst the Powell straw layer has considerably reduced the manual labour involved in straw laying, it has still been necessary to have one or more labourers following the apparatus for the purpose of manually tucking the deposited straw beneath the plants.

One object of the present invention therefore is to provide, for use in conjunction with straw laying apparatus, a device for distributing the straw sideways thus avoiding the need for the straw to be tucked beneath the plants by hand.

According to this aspect of the present invention there is provided apparatus for depositing a layer of material to form at least one row as the apparatus is moved in a given direction, said apparatus including a device for effecting sideways distribution of the material after it has been deposited on the ground, which device comprises at least one tined rotor located rearwardly of the or each position at which the apparatus discharges the material and inclined with respect to said direction of movement so that, as the tined rotor moves lengthwise of the row, the tines embed into the material with consequent sideways displacement of the material entrained by the tines as the rotor rotates.

In the preferred embodiment, there is provided a pair of such tined rotors behind the or each discharge position, the rotors of each pair being inclined with respect to each other in wedge-line relation with the narrow end of the wedge directed forwardly whereby the material is displaced to either side as the rotors rotate.

Preferably, the or each rotor is adjustable angularly independently of any other rotors that may be provided so that, in the case of paired rotors as mentioned above, the angle of the wedge is adjustable. In this manner, the degree of sideways displacement can be adjusted. Each rotor of a pair of conveniently mounted independently of the other so that any up and down deflection of one rotor from a neutral floating position caused by obstacles such as clumps of straw or uneven ground are not transmitted to the other rotor.

Although the rotor or rotors may be located immediately behind the discharge position, it has been found that a more effective result can be obtained if a ground engaging roller or wheel is located behind the discharge position so as to flatten the discharge material, the rotor or rotors then being located behind the wheel or roller for cooperation with the flattened layer.

The rotors are preferably suspended in such a way that the tines contact the ground with sufficient pressure that the act of moving the apparatus causes the rotors to turn by virture of such engagement of the tines with the ground. To enable the tines to free themselves from the material after completion of the sideways displacement, they preferably extend obliquely with respect to the axis of rotation of the respective rotor such that the outer extremities of the tines trail their inner extremities in the intended direction of rotation of the rotor. Preferably also the tines are inclined in the axial direction relative to its axis of rotation and the tines may be of arcuate configuration. Conveniently the tines are resiliently deformable about their roots.

In the preferred embodiment, each rotor is mounted on the rear end of the two part arm which is pivoted at its forward end about a substantially horizontal axis and is spring loaded into a floating neutral position in which tines bear lightly against the ground. Each arm comprises two parts hingedly connected about a substantially vertical axis and means is provided for securing the parts together at a selected angle which dictates the angle of the wedge.

Where the apparatus is designed to lay two or more generally parallel spaced rows of material at a time and therefore has two or more laterally spaced discharge positions, it will be understood that a corresponding number of pairs of tined rotors as described above may be located one pair behind each such discharge position.

In some circumstances, for example during manoeuvring upon completion of one row (or set of rows) it may be necessary to move the apparatus in the reverse direction. To avoid damage to the rotors as a result of the tines burying themselves into the ground during such reverse movement, means is conveniently provided for raising the or each pair of rotors above the neutral position and out of ground contact. Such means may be operable under manual control or may operate automatically in response to any attempts to reverse the normal direction of travel of the apparatus.

Besides being applicable in the distribution of straw and like material, according another aspect thereof, the device of the invention may be used in a ground treatment process such as soil cultivation. According to this aspect of the invention there is provided a device comprising at least two rotors disposed at an angle to each other wedge-like fashion, each rotor being provided with a series of outwardly projecting tines and said device being mounted on or being adapted to be connected to a vehicle with the rotors inclined in opposite directions with respect to the designed direction of travel and in such a way that as each rotor turns in response to being drawn across the ground its tines move towards the narrow end of the wedge as they move away from the bottom position.

In this application of the invention, the device is so arranged that its tines tend to bury into the ground thereby enabling the device to be used to effect working down of ploughed land for example. Thus, as the tines rotate upwardly from their bottom position they tend to lift lumps of each and because the rising tines are converging towards the narrow end of the wedge they tend to breakdown the lumps. For this application, it may be necessary to provide some form of depth control means to limit the extent to which the tines can penetrate into the ground so as to obviate the risk of the rotors burying deeply into the ground. As with the staw laying device, the rotors may be carried on arms which may be adjustable horizontally and/or vertically. However, instead of employing tines which are capable of flexing, it may be necessary to employ relatively rigid tines. In use, a tractor may be provided with a number of pairs of such rotors which may be trailed behind the tractor with the narrow ends of the wedges directed rearwardly.

The straw (or like material)- distributing version of the device according to the invention may be used instead for other applications such as turf-conditioning, eg to scratch out moss, dead grass and such like in playing field turf. It is envisaged that for this application a number of tined rotors as aforesaid may be located side-by-side but, in this instance, they may all be generally parallel to one another as the wedge-relationship is not essential. In particular, the tines will be mounted as previously described so as to flex about coiled portions thereof so that the risk of breaking is reduced.

To promote further understanding of the invention, one embodiment will now be described by way of example with reference to the accompanying drawings in which :

Figure 1 is a perspective view showing the device according to the invention;

Figure 2 is a plan view;

Figures 3 and *4* are end and side views showing diagrammatically the manner in which each tine is mounted; and

Figures 5 and *6* are plan and side views showing diagrammatically the location of a scraper member for freeing straw from the rotor tines.

Referring now to the drawings, the rear end left hand side only of a Powell straw layer is illustrated. The wheel 12 is mounted on the frame of the straw layer and serves to support the left hand side of the rear end of the apparatus, the front end being connected to, for example, the three point linkage of a tractor. The right hand side of the frame is provided with a similar ground-engaging wheel. Each wheel 12 is located immediately behind the respective bale processing drum and housing, which may be of the form disclosed in our published patent application No. 2014422, so that the wheel 12 runs over the discharged straw and flattens it thereby forming a row of straw between adjacent rows of strawberry plants.

To avoid the need for subsequent handwork as has been necessary in the past in order to tuck the straw beneath the plants on each side of each row of straw, each drum and housing unit of the straw layer has a distributing mechanism associated with it in the form of a pair of tined rotors 16 mounted on arms 18 located one on each side of the wheel 12 and arranged in wedge-like relation with the narrow end of the wedge directed forwardly. Each rotor 16 is mounted freely on a stub axle extending laterally from the rear end of the respective arm 18 and the arms are pivoted at their forward ends about generally horizontal axes so as to allow up and down motion of the rotor 16. The arms 18 are resiliently supported in a floating neutral position by springs 20 so that the the tines bear lightly against the ground with sufficient pressure to cause the rotor 16 to rotate as the apparatus moves in the forward direction. The force exerted by the spring loading may be adjustable, e.g. by providing a number of vertically spaced anchorage points (not shown) on the upright 22.

The arms 18 are pivoted independently of one another so that if one arm is displaced by an obstacle this does not interfere with the other arm. To enable the angle of the wedge to be adjusted, each arm comprises two parts 24, 26 hinged at 28 so that the rear part 26 can hinge in a substantially horizontal plane (when the arm is in its neutral position). The parts 24, 26 have a number of holes 30 which are brought into registry at various adjusted settings of the parts 24, 26 to enable a locking pin or the like to be inserted so as to hold the parts in the required position of adjustment.

As previously mentioned, the tines of each rotor extend obliquely relative to the axis of rotation and consequently would tend to bury into the ground if the apparatus is moved in the rearward direction. All of the arms 18 may therefore be connected to a common lifting bar (not shown via chains for example so that they be raised whenever the apparatus is driven in reverse. The chains will be of such a length that they do not interfere with the normal floating movement of the rotors. The tines conveniently have some degree of resilience to reduce the risk of breakage and they may be formed from rod or strip and wound into coils at their inner extremities to enhance their resilience. The rotors 16 are fabricated from a tine-carrying disc 40 (see Figures 3 and 4) to which a number of bosses 42 are welded and to which the tines are assembled with their coiled portions 44 encircling the bosses 42 with some degree of play so that when the tines are deflected, the coils may contract radially. At its inner extremity each tine is formed with an eye 46 by means of which the tine is secured to the disc 40 by a nut and bolt 48.

It will be seen from Figures 3 and 4 in particular that each tine can deflect in the directions A and B thereby reducing the risk of breakage. This risk is further reduced by the torsion mounting of the tines afforded by the coiled portions 44.

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It will be seen from Figures 3 and 4 in particular that each tine can deflect in the directions A and B thereby reducing the risk of breakage. This risk is further reduced by the torsion mounting of the tines afforded by the coiled portions 44. A second disc 48 is secured to the disc 40 and may be of larger diameter than the disc 40. The disc 48 serves to prevent straw from wrapping around the respective rotor.

Figures 5 and 6 show a modification involving the provision of a scraper element 50 which co-operates with the tines to assist in freeing the straw therefrom, especially as the tines rise from their lowermost position. The element 50 may be generally arcuate and may be secured to the arm 26 as shown.

From the foregoing, it will be understood that as the apparatus travels lengthwise of the rows of strawberry plants, the tined rotors 16 are caused to rotate by contact of the tines with the ground, thereby entraining the straw and shifting it sideways either side as a result of the wedge-like relation of the rotors. The oblique arrangement of the tines enables them to free themselves from the entrained straw as they move upwardly and the floating mounting of each arm 18 allows the rotors to move up and down independently of each other to compensate for uneven ground and obstacles such as clumps of straw.

CLAIMS (Filed on 3 June 1982)

1. Apparatus for depositing a layer of material to form at least one row as the apparatus is moved in a given direction, said apparatus including a device for effecting sideways distribution of the material after it has been deposited on the ground, which device comprises at least one tined rotor located rearwardly of the or each position at which the apparatus discharges the material and inclined with respect to said direction of movement so that, as the tined rotor moves lengthwise of the row, the tines embed into the material with consequent sideways displacement of the material entrained by the tines as the rotor rotates.

2. Apparatus as claimed in Claim 1 in which there is provided a pair of such tined rotors behind the or each discharge position, the rotors of each pair being inclined with respect to each other in wedge-like relation with the narrow end of the wedge directed forwardly whereby the material is displaced to either side as the rotors rotate.

3. Apparatus as claimed in Claim 1 or 2 in which the or each rotor is adjustable angularly independently of any other rotors that may be provided so that, in the case of paired rotors as mentioned above, the angle of the wedge is adjustable.

4. Apparatus as claimed in Claim 2 in which each rotor is mounted independently of the other so that any up and down deflection of one rotor from a neutral floating position caused by obstacles such as clumps of straw or uneven ground are not transmitted to the other rotor.

5. Apparatus as claimed in any one of Claims 1-4 in which a ground engaging roller or wheel is located behind the discharge position so as to flatten the discharged material, the rotor or rotors then being located behind the wheel or roller for cooperation with the flattened layer.

6. Apparatus as claimed in any one of Claims 1-5 in which the or each rotor is suspended in such a way that the tines contact the ground with sufficient pressure that the act of moving the apparatus causes the rotors to turn by virtue of such engagement of the tines with the ground.

7. Apparatus as claimed in any one of Claims 1-6 in which the tines extend obliquely with respect to the axis of rotation of the respective rotor such that the outer extremities of the tines trail their inner extremities in the intended direction of rotation of the rotor.

8. Apparatus as claimed in any one of Claims 1-7 in which the tines are inclined in the axial direction relative to the axis of rotation.

9. Apparatus as claimed in any one of Claims 1-8 in which the tines are of arcuate configuration.

10. Apparatus as claimed in any one of Claims 1-9 in which the tines are resiliently deformable about their roots.

11. Apparatus as claimed in Claim 2 or any one of Claims 3-10 when appendant to Claim 2 in which each rotor is mounted on the rear end of the two part arm which is pivoted at its forward end about a substantially horizontal axis and is spring loaded into a floating neutral position in which tines bear lightly against the ground.

12. Apparatus as claimed in Claim 11 in which each arm comprises two parts hingedly connected about a substantially vertical axis and means is provided for securing the parts together at a selected angle which dictates the angle of the wedge.

13. Apparatus as claimed in any one of Claims 1-12 in which there are two or more laterally spaced discharge positions and a corresponding number of pairs of tined rotors located one pair behind each such discharge position.

14. Apparatus as claimed in any one of Claims 1-13 in which means is provided for raising the or each pair of rotors above the neutral position and out of ground contact.

15. A device comprising at least two rotors disposed at an angle to each other in wedge-like fashion, each rotor being provided with a series of outwardly projecting tines and said device being mounted on or being adapted to be connected to a vehicle with the rotors inclined in opposite directions with respect to the designed direction of travel and in such a way that as each rotor turns in response to being drawn across the ground its tines move towards the narrow end of the wedge as they move away from the bottom position.

16. Apparatus substantially as hereinafter described with reference to, and as shown in, the accompanying drawings.

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